

REVIEW

Рх. № 267 / 12.04. 2022г.

of dissertation for the award of educational and scientific degree "doctor"
scientific field 5. "Technical sciences", professional field 5.2 "Electrical engineering,
electronics and automation", doctoral program / specialty "Automated systems for
information processing and control",

topic: "INNOVATIVE TECHNOLOGIES TO INCREASE EFFICIENCY IN THE
PRODUCTION OF TUBULAR FURNITURE"

author of the dissertation: mag. PETAR PAVLOV PANEV

Scientific adviser: Prof. Dr. DIMITAR KARASTOYANOV

Member of the Sci. Jury Prof. Dr. Lyubomir Vankov Dimitrov, Technical University - Sofia,
appointed by Order 53 / 01.03.2022. of the Director of ICT-BAS

General characteristics of the dissertation

The dissertation has a volume of 133 pages, with an introduction, five chapters,
contributions, a list of publications on the dissertation and a bibliography of 100
references, 101 figures and 19 tables are attached.

1. Relevance of the problem developed in the dissertation in scientific and scientific-applied terms.

The dissertation of mag. Petar Panev is in the scientific and scientific-applied
direction for automation in the production of tubular furniture - modules and entire
products, through the design of automatic machines controlled by programmable
controllers (PLC), as well as appropriate application software. The main goal is to increase
reliability and productivity. There is a lot of research and development in the world on
individual topics, but in total they are rare in our country. This determines the relevance
and innovation of research and development of mag. Panev.

2. Degree of knowledge of the state of the problem and the literature.

An extended detailed literature review of the considered practices in our country
and around the world, existing, new and innovative methods, techniques and technologies
for research and analysis has been made. The presented material shows in-depth
knowledge of the developed topic, what are the current problems in the field, as well as the
potential opportunities for their solution. On this basis, the purpose and tasks of the
dissertation are formulated.

3. Compliance of goals and objectives with the achieved results.

The review, analysis and conclusions of the theoretical researches made and
realized by the PhD student, existing methods and means for engineering expert analysis,
give an opportunity for development and application of approaches for improvement of
efficiency and productivity, for solving the set goals and tasks of the dissertation. Modern
solutions are realized through the application of innovative approaches and calculation
procedures.

From well-formulated, substantiated and motivated goals and tasks, the PhD
student has contributed to the realization of the dissertation and the real contributions. The

obtained results show that the PhD student has successfully chosen the research apparatus for obtaining new results with scientific-applied and applied contributions.

In the dissertation the author has set himself the task to consider problems and investigate operations related to the production of tubular furniture - cutting, punching, welding, painting and packaging.

The main goal of the dissertation is to study the progress and to initiate the introduction of new technologies to increase the efficiency and productivity of tubular furniture through modern research methods and innovative means of production.

Taking into account the set goal, the following tasks are formulated:

1. Detailed overview and analysis of the various methods and tools for cutting, punching, welding, painting and packaging of tubular furniture and components.
2. Research of existing methods and means for the production of tubular furniture.
3. Design of automatic machines to increase the productivity and quality of tubular furniture products.
4. On the basis of the projects to construct innovative machines, which will increase the productivity of automatic table leg machines.
5. To propose approaches and methodologies to increase the efficiency and productivity of automatic table leg machines.
6. To conduct experiments and simulations of various methods for design and construction in industrial environments.
7. The obtained results should be analyzed and tested.

4. Brief analytical characteristics and assessment of the reliability of the material.

Chapter 1 provides an overview, analysis and systematization of an exemplary plant for the production of tubular furniture and modules. An in-depth analysis of existing automatic machines and lines, packaging materials and problems with packaging processes has been made. Types of products with tubular construction are described - sofas, beds, table legs. Innovative technologies and packaging operations are presented.

Chapter 2 presents the existing methods and means for the production of elements for tubular furniture on the example of the "Curry" leg: punching and shaping of parts, welding of parts, packaging of the finished product. The possibilities for optimization of the packaging processes, as well as the actual and desired productivity and reliability have been studied. Different structural options for packaging of finished products are presented.

Chapter 3 presents methods and approaches for designing innovative machines in order to increase efficiency and productivity in the production of tubular furniture - welding a cup with a bolt, laser welding of a tube to a cup / bolt, packaging of all components for table leg and program for automatic gluing of cardboard tape. Based on the compiled methodologies, the desired productivity is calculated, automatic machines are designed according to the requirements for geometric accuracy, regulatory requirements for safety of equipment in case of mechanical hazards and SolidWorks drawing software; equipment and methodology for automated packing of table legs have been selected. A Methodology for achieving high productivity in packaging has been developed.

Chapter 4 examines the technological and operational performance of innovative machines and describes the results achieved after the construction of automatic machines

for cup welding, laser welding of tube to cup / bolt and packaging of all components for table leg. The desired and actual performance of the automatic machines are calculated.

Chapter 5 presents the future projects for the development of the production of tubular furniture - innovative leg and shuttle welding department.

5. Scientific and scientific-applied contributions of the dissertation.

The contributions in the dissertation have mainly scientific-applied and applied character and are presented as follows:

1. The various methods and means for realization of processes of punching, welding and packing of tubular products are analyzed and systematized.
2. Existing problems, solutions and desired changes concerning the production of tubular furniture are discussed.
3. The influence of ICT on the methods of production of tubular furniture is studied.
4. Innovative approaches and methodologies are proposed for the design of machines for automatic punching of the heel and cup of the table leg and for increasing the efficiency and productivity of automatic table leg machines.
5. Innovative methods are proposed to increase the productivity of packaging.
6. Designed, developed and implemented in production is an innovative automatic assembly machine in two versions.
7. Innovative semi-automatic packaging line is designed, developed and implemented in production.
8. A structural layout of an innovative automatic packaging line is proposed.
9. Experimental developments and simulations of various methodologies in industrial environment have been made.
10. Intellectual property is protected.
11. The developed automatic machines are in accordance with the EU standards.
12. Methodological assistance was provided in mastering the principle of their work
13. The quality, volume and efficiency of the produced products are increased
14. The results of the experiments are verified and analyzed in order to improve the quality of production and its productivity
15. Future projects are proposed - Innovative leg.

I accept and evaluate positively formulated by the PhD student the scientific-applied and applied contributions, reflected in the dissertation and the abstract. It would be good for them to be consolidated and grouped.

6. Assessment of the degree of personal participation of the dissertation in the contributions.

I believe that the dissertation and its contributions are the personal work of the PhD student, with the extremely skilled guidance of his supervisor and with the help of the participants from his team.

7. Evaluation of the publications on the dissertation.

The PhD student has presented 7 publications on the dissertation, of which: 3 are independent. Of the publications, 2 are at International Events Abroad (1 SCOPUS

visible), 5 at Conferences in Bulgaria. There is 1 document for protection of intellectual property - utility model.

In general, the publications presented in the dissertation reflect the essential part and the main results of the conducted research. With the publications made, the results of the dissertation have become available to our scientific community.

8. Using the results of the dissertation in practice.

The PhD student has performed a large volume of work, characterized by comprehensiveness, depth and competence. The work describes well the innovative approaches and methodologies in order to improve efficiency and productivity. Specific automated packaging machines have been developed.

9. Assessment of compliance of the abstract and the requirements for its formation.

The abstract has a volume of 37 pages and fully reflects the content of the dissertation. It meets the requirements and essentially reflects the set and solved goals and objectives, the results obtained and the main scientific-applied and applied contributions and presents exactly the main achievements in scientific work.

A summary in English is attached.

10. Opinions, recommendations and remarks.

I have no notes that would call into question the reliability of the results presented in the dissertation and the contributions.

I have shared some remarks of a technical and stylistic nature with the PhD student. I also recommend the PhD student more independent articles in foreign journals.

CONCLUSION

The remarks made are mainly of a technical nature. In conclusion, I believe that the author has made an in-depth study of the problem, analyzed the results of the study and proposed a comprehensive solution in a new and promising area. The basic requirements of ZRASRB, of the Regulations for its application are fulfilled, as well as the specific requirements for acquiring a scientific degree in IICT-BAS in terms of scope, volume and quality of the dissertation. **On this basis, I appreciate the work and offer it to the mag. Eng. Petar Pavlov Panev to be awarded the scientific and educational degree "DOCTOR" in field 5. Technical sciences; direction 5.2. Electrical engineering, electronics and automation; scientific specialty: Automated systems for information processing and management.**

Sofia,
March 28, 2022.

Reviewer

НА ОСНОВАНИЕ

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